



Memo

Date January 23, 2006
Job No 2005398
To Nancy Richardson Ahern
Seattle Public Utilities
From Randy Barber
rbarber@olympicassociates.com
Re Thornton Creek Water Quality Channel
Cost and Constructability Memo

Comments

Olympic Associates was retained by Seattle Public Utilities to provide constructability and cost input on the 30% design for the Thornton Creek Water Quality Channel project. The basic function of the project is to improve the water quality of the runoff in the Thornton Creek drainage basin. The basin area upstream from the location of the channel is some 680 acres. Only a portion of the runoff from the basin will be diverted through the water quality channel to provide water quality treatment and year-round flow.

The water quality channel is to be constructed near the intersection of 3rd Ave. NE and NE 100th St. in Seattle. It will be bordered by the Northgate Commons project being developed by Lorig Associates to the north and west, and by an ERA Care facility to the southwest. Residential, commercial and office developments lie outside of the immediate area of development, notably Northgate Mall to the north of the project.

The City's parcel will be developed in two phases. The first phase will include the rough grading coordinated with the Northgate Commons development. The current plan would be for the City to enter into a lump sum agreement with Lorig's contractor for earthwork. Work is anticipated to begin in early June 2006, with grading completed and the site acceptable to the City on or before March 15, 2007. It is our opinion that minimal City involvement in this first phase contract provides the optimum risk mitigation to the City.

The second phase would be a contract through a competitively bid process by the City for the completion of grading required for the channel, installation of site retaining walls, installation of landscaping required for bio-filtration and site amenities, such as pedestrian paths and bridges, site benches, etc. This phase would begin construction on or about April 15, 2007 and be substantially complete by November 15, 2007. Physical completion of work is anticipated for the first quarter of 2008, with final completion of the landscape establishment period by the end of 2008. Water would not be diverted into the channel until the end of the establishment period.

The primary constructability issues as we see them are as follows:

1. Physical area constraints of the site. Given the amount and nature of the work involved, this is a tight site to construct in. Soils are generally characterized as



Memo, Continued

glacial till and mixed unconsolidated fill. Depending upon weather, this could lead the project to export all excavated material and import fill for wall footings (as necessary) and for backfill behind walls, as is the assumption for the latest cost estimate. There will be issues related to keeping streets clean and in the logistics related to the coordination of excavation and wall construction work.

We recommend being very explicit regarding expectations for street cleaning, dust control and security. We wouldn't anticipate this type of a project to have the need for a great deal of staging area, but will certainly need some for concrete forms, materials for the green wall, and landscape plantings. This will be coupled with trucks moving into and out of the site with export and import material, thus creating the potential for congestion. As the general contractor will be responsible for site logistics, we recommend requiring a submittal of a site utilization plan prior to construction. One also needs to realize that needs and availability will change as construction progresses. Major changes in methodology or execution strategy may trigger the need to revise such a plan. This plan can be used to keep the community informed regarding what to expect during the construction period.

2. A second issue surrounds the installation of retaining walls. As we understand, the concept began with soil wrap green walls as the predominant wall type. At present, there are two types of walls being considered. Concrete walls comprise less than 50% of the total wall surface area in the 30% design estimate, with green walls comprising the majority of wall surface area. A number of different types of green or plantable walls have been considered, including rockeries, concrete crib walls, interlocking unit-type walls, such as PISA Wall System or similar, and mechanically stabilized earth (MSE) walls. Each has advantages and disadvantages, with MSE walls generally being favored. During the course of the recent workshops, installing green walls with variable batter along the wall face, from 1:4 to 1:1, was agreed to in concept. Specific details will need to be developed to deal with the various wall conditions, including variable wall face batter, wall heights above and below 4 feet, location in the channel or in upland areas, green wall backfill compaction requirements, and wall end/interface conditions between the various wall types. From discussions at the project meetings, it would appear the designers have a concept in mind for the interface. The ability to compact at the interface between the two wall types will need to be reviewed and assessed for adequacy. Additionally, the potential for undermining of MSE walls at the interface where the channel horizontal alignment meanders should be reviewed. We believe this possibility would only exist when heavier rainfall events happen and flow rates are increased. The design team should weigh in and review this type of condition.
3. Existing 60-inch drainage conduit. The design team has been operating under the direction from SPU field operations that a minimum 5' setback would be required from the existing 60-inch pipeline. It isn't clear what the setback prism at the pipe



Memo, Continued

looks like. One concern we see is that the bottom of the MSE wall may be below the top of the 60-inch pipe. If this is true, and one takes the base of the excavation for the MSE wall to 5' from the pipe, the cut slope will extend such that less than 5' of cover is left over the pipe. With this area now requiring backfill and compaction, the pipe could be damaged by construction. We recommend that a profile for the base of the wall be developed and plotted against the pipeline profile. Sections could then be cut to determine the amount of cover over the pipeline.

An additional concern about the pipeline relates to its construction material. We understand that a video of the interior of the pipeline has been done, but have not seen the tape. Construction documents from its installation haven't been found, but may be available from King County archives. There is a plan being developed to pothole at various locations along the pipeline to ascertain its construction type and its condition. We recommend this be done at the earliest possible date as there are potential issues with other parts of the project that are affected by this information. As with any pipeline of this age, we recommend care be taken when working in and around this facility. At some 40-50 years old, it could be in a fragile state and easily damaged by exploration. Given the time of year, a failure of this line would have serious impacts to the neighborhood and ample care and precautions needs to be taken.

4. The timing on construction of the diversion structure vault and outfall vault is also an issue. The vaults could be constructed in either phase of the project, but would be much less expensive to construct in the second phase due to less excavation and shoring being required. However, Lorig or ERA Care may wish to discharge to the pipe via one of the new structures. If so, they would need a discharge option (temporary or permanent) earlier than when Phase 2 construction is anticipated.. SvR, the civil designer, indicated at our cost and constructability review meeting that either a cast-in-place or pre-cast vault would be acceptable. For both cost and constructability reasons, we recommend that a pre-cast vault be installed. Neither the current plan nor the cost estimate account for use of select backfill such as CDF for this location. We recommend that be planned as part of the design to reduce backfill compaction loads over the top of the 60-inch pipe, a portion of which will need to be exposed during vault installation. We also recommend that pipe support requirements during the time the pipe is exposed for vault construction be clearly identified in the specifications.
5. The 30% drawings indicate the pedestrian bridge foundation could bear on top of an MSE wall. We understand the structural engineer has indicated that adequate bearing capacity is available, but we have some concerns as related to differential settlement as well as long-term stability if the wall it bears on is planted. Our recommendation would be to use concrete bearing walls on both ends of the pedestrian bridge as concerns related to long-term settlement and stability would be alleviated.



Memo, Continued

Cost issues:

We were provided with a history of the project cost estimating, including the 8/30/05 hybrid and 9/20/05 terraced option (revised hybrid design) concept cost estimates. The 30% design estimate is a refined number from the terraced option estimate. We weren't surprised to see the majority of the costs in a few line items, with approximately 1/2 of the anticipated construction cost in four line items: landscaping, earthwork, temporary erosion control and green walls. The single largest cost item is landscaping, which currently includes irrigation, site amenities and other related items. This would lead us to assume that it would be difficult to make a significant reduction in the project construction costs as these line items are critical to the successful completion of the project. Specific issues are as follows:

1. In our review of the estimate, we didn't see a line item that would cover overhead costs required of the successful general contractor. This would cover items such as field supervision, shop drawings and submittals, bonds and insurance, safety and security costs, field offices, dust and/or mud control, street cleaning, record drawings, etc. The unit prices in the estimate seem to reflect the cost to do the work and do not appear to include general conditions, overhead and profit, etc. The next revision should include a line item for these costs.
2. The estimate also doesn't include an identified line item for cost escalation. As a large part of the project cost won't occur for over a year, this should be accounted for. SPU should clarify what point in time the \$3.9M maximum allowable cost of construction or MACC (less the negotiated amount to be paid for earthwork in phase 1) represents. It is our understanding that it should be representative of the prices submitted by bidders in early 2007. If this is the case, then a line item for escalation needs to be added to the anticipated cost of construction.
3. The most volatile part of this project would seem to be the price of fuel, which has impacted construction costs this year and will continue to do so in the future. This is a project that is heavy in equipment and truck use. Trends should be tracked and unit prices adjusted accordingly. Additional trends that could affect unit prices include reconstruction of the southeastern US following hurricanes, the Olympics in Vancouver, BC
4. The unit price for excavation, at \$15 - \$16.50 per cubic yard, may be low. Given the urban location, all excavated materials will be hauled and dumped. With the likelihood of congestion on I-5, cycle times will be extended, thus driving up the unit price. We recommend adjusting the price for excavation and haul upwards to reflect this condition.
5. The quantity of materials or construction type will have a bearing on the ultimate unit price a contractor bids for the work. With the percentage of concrete walls of in the 30% design at less than 50% of the total, we believe the unit price will have a



Memo, Continued

tendency to be higher as there is less repetition and reuse of forms. We recommend review of the unit price for the concrete walls.

6. The unit price of the green walls appears to be representative of linear horizontal installations. Curvilinear wall alignments, as are predominant in the 30% design, will have a tendency to drive the unit price up due to additional effort required in the layout, quality control and construction of curved sections. The unit price for these walls should be reviewed and increased as necessary to reflect the additional layout and quality control costs associated with curved sections.
7. We recommend reviewing unit prices and adjusting as necessary to reflect the tight site conditions. The cost estimate should clarify productivity assumptions and reflect productivity losses in constrained areas. This could include increases in the cost of excavation, wall construction, backfill, etc.
8. As mentioned before, we recommend using pre-cast concrete vaults for the diversion and outlet structures as this is a more cost-effective solution. Care will be needed in sealing the vaults.
9. It was mentioned that landscape costs have been based on an area allowance to this point and include irrigation, site amenities and other related items. Additional landscape cost detail as well as splitting out specific costs for irrigation, amenities and the like will be provided with the next estimate. Given the nature of plant materials and the time available between physical completion and the first diversion of flows into the channel (approximately 1 year), we recommend examining the concept of not planting for 100% coverage at the outset and letting plants fill in. Environmental permits generally require that a minimum plant survival rate of 90% be achieved for water quality projects. This should be factored into the planting plan.
10. We recommend looking at various alternatives for walkways. The estimate currently assumes porous pavement which is a costly solution to the issue. The potential limits and locations of alternative pavement sections should also be taken into consideration to account for the nature of the surrounding population.
11. We recommend that bid alternates be given thought from this point forward. The only problem is that on a heavy civil works project, there generally aren't many opportunities for bid alternates. Bridges may be an option to consider. At this time, we noted three bridges in the project, two of which are part of culverts in the channel. Is there a potential for reducing the number of crossings of the channel?
12. The issue of construction over the top of the existing 60-inch pipe should be given consideration when establishing unit prices in the estimate for line items that will be installed in and around the pipe. Work over and around that facility will need to be given additional care, and may require different or specialty equipment, thus resulting in a higher unit price.



Memo, Continued

13. The issue of an automated weir was discussed at the cost and constructability meeting on January 6, 2006. As we understand it, the weir would be raised or lowered from flow sensors placed somewhere in the channel or at the diversion structure. While this seems technically feasible, this introduces significant cost and complexity into the project as well as long-term maintenance issues. As an example, how would the mechanical weir be operated, via motors activated by flow sensors or via some sort of manual screw operator? If automated, there is a level of complexity in the involvement of SCADA design members, as well as communications between sensors and motors. This would also require some sort of housing to be constructed, which will also require maintenance. Additionally, this could increase the risk of either upstream or downstream (depending upon the elevation of the weir) flooding if a mechanical or electrical failure occurs. Given that we believe the estimate to be low, we would not recommend further consideration of this idea.
14. A stair from NE 100th St. at 4th Ave. NE apparently will be included in the project scope and needs to be included in the design documents and the next estimate.
15. The question related to the location of the diversion structure was one we were asked to comment on. It is our opinion that installation costs for the diversion structure will be lower at the location presently shown in the 30% design documents than if it were installed in street right-of way. Installation in the street would have been deeper, requiring more shoring, utility interferences, excavation, traffic control, disruption to Metro, additional safety and security measures, etc. All of these factors would have impacted production, thus driving up cost, and increasing risk during construction. We concur with the decision to relocate the diversion structure.

We have the following recommendations related to the design effort for this project.

1. It appears that MSE walls will be used as the green wall alternative for the project, though we're not sure that alignments have been finalized. We recommend finalizing the horizontal alignments of the green walls as soon as possible. The constructability and cost issues highlighted above should be taken into consideration as material selection, construction methods and locations are finalized.
2. Prepare a more detailed estimate from the revised plans. This should take into account the materials, methods, layouts and alignments, phasing, construction periods, construction areas/zones, escalation and contingencies. This will provide better information regarding where the project is from a cost perspective and will assist in decision making. We would recommend this be done sooner rather than later, and could potentially substitute for the 60% estimate. OAC would be available to consult in the preparation of this estimate.



Memo, Continued

3. Review options for monitoring costs for excavation. Once a calculation and payment method is decided upon, begin the process of drafting the bid documents to reflect that decision. As excavation is one of the major cost drivers, this will be important in both estimating and controlling costs.
4. To the best of your ability, lock down elements that are in the project to prevent scope creep. All stakeholders must be comfortable with the scope of the project within budgetary constraints. Offsite improvements required by other City agencies must be identified and agreed to at the earliest possible date.

Copy to: Miranda Maupin
Tom Fawthrop